Canadian Space Agency

2017–18

Departmental Plan

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Minister of Innovation, Science and Economic Development

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Table of contents

Minister's message 1

Plans at a glance 3

Raison d'être, mandate and role: who we are and what we do 5

- Raison d'être 5
- Mandate and role 5

Operating context: conditions affecting our work 7

Key risks: things that could affect our ability to achieve our plans and results 9

Planned results: what we want to achieve this year and beyond 13

- Program 1.1: Space Data, Information and Services 13
- Program 1.2: Space Exploration 16
- Program 1.3: Future Canadian Space Capacity 20
- Internal Services 24

Spending and human resources 27

- Planned spending 27
- Planned human resources 29
- Estimates by vote 29
- Future-Oriented Condensed Statement of Operations 30

Supplementary information 33

- Corporate information 33
- Supporting information on lower-level programs 35
- Supplementary information tables 35
- Federal tax expenditures 35
- Organizational contact information 36

Appendix: definitions 37

Endnotes 41

Minister's message

Our 2017–18 Departmental Plan provides parliamentarians and Canadians with information on what we do and the results we are trying to achieve during the upcoming year. To improve reporting to Canadians, we are introducing a new, simplified report to replace the Report on Plans and Priorities.

The title of the report has been changed to reflect its purpose: to communicate our annual performance goals and the financial and human resources forecast to deliver those results. The report has also been restructured to tell a clearer, more straightforward and balanced story of the actual results we are trying to achieve, while continuing to provide transparency on how tax payers' dollars will be spent. We describe our programs and services for Canadians, our priorities for 2017–18, and how our work will fulfill our departmental mandate commitments and the government's priorities.

Through the programs of the Innovation, Science and Economic Development Portfolio, we are working together to deliver Canada's Innovation Agenda—a whole-of-government initiative to position Canada as a global centre for innovation, create better jobs and opportunities for the middle class, drive growth across all industries and improve the living standards of all Canadians. The work of the Portfolio also includes commercializing more research and ideas; providing more Canadians with the skills to participate in a global and digital economy; helping small businesses grow through innovation, access to capital and trade; promoting increased tourism to Canada; and supporting scientific research and the integration of scientific considerations in our investment and policy choices.

It is my pleasure to present the Departmental Plan for the Canadian Space Agency for 2017–18.

The Honourable Navdeep Bains
Minister of Innovation, Science and Economic Development

Plans at a glance

For each of the CSA's Programs, key planning highlights that the CSA will focus on in 2017–18 are presented. They strive to fulfill the CSA's mandate and Government commitments to and for Canadians. All these initiatives are aligned with the mandate letter sent to the Minister of Innovation, Science and Economic Development (ISED), which states that the minister's overarching goal will be to help Canadian businesses grow, innovate and export. These key objectives also reflect numerous consultations and forums held with industry, the science community and federal government representatives throughout the last year.

Provide space-based data and services for the benefit of Canadians

The key initiatives of the Space Data, Information and Services program will be aimed at providing space-based solutions that are essential to the safety, security and well-being of Canadians. This extends from disaster response to precision farming and from tracking vessels in Canadian waters to climate change monitoring. Through its participation in the delivery of space-based solutions, the Canadian industry will expand its capacity both to build sophisticated satellite systems and payloads, and to develop value-added products and space-based solutions, thereby increasing the value chain.

These initiatives will also support other ministers in making investments that will make our resource sectors world leaders in the use and development of clean and sustainable technology and processes as stated in the mandate letter sent to the Minister of Small Business and Tourism. To this effect, the CSA will collaborate with other departments such as Fisheries and Oceans and the Canadian Coast Guard, Environment and Climate Change, Natural Resources Canada, and Agriculture and Agri-Food, to address key responsibilities related to government priorities of climate change, and resource and ecosystem management using space-based solutions. It is expected that in FY 2017–18, Environment and Climate Change Canada's Ecosystem and Environment Assessments Program will be added to the current 38 Government of Canada (GoC) programs using CSA-enabled Earth Observation data or derived information to deliver departmental mandates. Earth observation data will also be provided to 17 research institution across Canada.

Provide innovative technologies and scientific instruments for space exploration

The key initiatives of the Space Exploration program in FY 2017–18 will be to leverage international partnerships to support fundamental research for new knowledge, and to identify and provide innovative technologies and scientific instruments as space exploration mission

enablers. These initiatives will be carried out through four program elements: Human Space Flight, Health and Life Science, Space Astronomy and Planetary Science.

These key initiatives are expected to bring changes to the Canadian space sector by enabling highly qualified personnel to work on generating new knowledge that, in turn, may be transformed into technological development and innovation, helping businesses grow and export. They are also aligned with government priorities and goals expressed in the mandate letter sent to the Minister of Science which states that the ministers' overarching goal will be to support scientific research and innovation.

Secure Canada's future in space

The key initiatives of the Future Canadian Space Capacity program in FY 2017–18 will be to secure Canada's future in space by supporting space science and technology development initiatives and activities. In doing so, the CSA will support Canada's space sector to develop leading-edge capabilities, enhance its export growth, and create high-paying middle-class jobs.

These initiatives will also contribute to the Innovation Agenda which aims at encouraging Canadians to develop science, technology, engineering and mathematics (STEM) skills to prepare them for the jobs of tomorrow. Space provides a highly visible means of motivating and inspiring young Canadians to pursue learning and opt for careers in STEM, as these are critical areas for an innovative economy. In collaboration with academia, industry and partners, the CSA will inspire post-secondary STEM students to choose careers in space by helping them develop the technical skills and expertise required to work in the space sector, and providing them with opportunities for employment. This will be done through various initiatives, based on the critical skills and capabilities needed to deliver Canada's space program.

Continuous Improvement Agenda

While the CSA delivers its space mandate to benefit Canadians, it is also imperative that the CSA continues to build a modern workplace and a culture of continuous improvements in the spirit of the guiding principles of Blueprint 2020. The Health and Wellness Strategy, aiming at providing a work environment that promotes health, psychological safety and working conditions conducive to wellness and vitality, will be key in achieving a well-being and a productive workforce.

For more information on the CSA's plans, priorities and planned results, see the "Planned Results" section of this report.

Raison d'être, mandate and role: who we are and what we do

Raison d'être

The Canadian Space Agency is committed tc leading the development and application of space knowledge for the benefit of Canadians and humanity.

Mandate and role

The mandate of the Canadian Space Agency[i] (CSA) is "to promote the peaceful use and development of space, to advance the knowledge of space through science and to ensure that space science and technology provide social and economic benefits for Canadians."

The CSA is delivering on its mandate in collaboration with Canadian industry, academia, Government of Canada organizations, and other international space agencies or organizations.

The founding legislation that received Royal Assent in 1990 attributed four main functions to the CSA:

- Assist the Minister to coordinate the space policies and programs of the Government of Canada;
- Plan, direct, manage and implement programs and projects relating to scientific or industrial space research and development and the application of space technology;
- Promote the transfer and diffusion of space technology to and throughout Canadian industry; and
- Encourage commercial exploitation of space capabilities, technology, facilities and systems.

For more general information about the department, see the "Supplementary information" section of this report. For more information on the department's organizational mandate letter commitments, see the Minister's mandate letter on the Prime Minister of Canada's website.[ii]

Operating context: conditions affecting our work

Canada's space sector is made up of a wide range of participants who rely on the development and use of space assets, capabilities, and data. These interdependent groups are drawn from across government, industry and academia, and perform key functions in the space ecosystem. The Canadian space sector also exists against a dynamic backdrop of new uses for efficient space-based services, enhanced commercial opportunities, and expanded international collaborations in an increasingly globally competitive environment.

New Applications, Players, and Commercial Opportunities

Many federal departments and agencies rely on space-based data to deliver their mandates, and many others expect to do so in the near future. Existing and planned space-based services help provide crucial evidence-based information on which the government can make decisions. Space-based data also supports critical government operations, such as search and rescue operations or pollutant tracking. Globally we see the space sector evolving due to the democratization of space driven by the miniaturization of various space technologies and the deployment of smaller satellites and satellite constellations which is driving down costs.

Acknowledging the potential of space, the number of countries investing in their own space programs has increased significantly in the last few years growing from 37 countries in 2003 to 80 in 2016 which means that Canada risks losing ground. This has transformed how space business is conducted, with more opportunities and competitiveness. This goes along with an increased potential in the availability of commercial applications.

To fully develop its growth potential and seize opportunities to join international space projects, the Canadian space sector must keep pace with a fast-evolving context. In line with the Innovation Agenda, the CSA supports the development of people and innovative technologies while offering demonstration opportunities to help Canada industry maintain and enhance its current competitive edge. As global innovation will lead to the development of disruptive technologies, Canadian space companies will need to refocus their efforts on new commercial opportunities by offering innovative space solutions.

The International Agenda

For countries like Canada, activities must be carried out in partnership with other spacefaring nations using innovative and affordable technologies to tackle some of the most pressing global issues such as climate change.

There are many opportunities to take an increased role in international partnerships and cooperation. The CSA makes directed investments in key technologies, flight opportunities, and support of innovation that ensures that the Canadian space sector remains relevant in a dynamic international context. To ensure alignment between the CSA's initiatives and the missions planned by partner agencies or pursued by the commercial space sector globally, the CSA works through international collaborations and international committees such as the Global Space Exploration Committee and the Committee on Earth Observation Satellites. The CSA also works closely with NASA and builds on its unique partnership with the European Space Agency (ESA) to leverage space investments as well as to maintain open access to European markets for Canadian space companies and academia.

Key risks: things that could affect our ability to achieve our plans and results

In a rapidly evolving context, with various needs and a protracted timeframe to develop space assets, there is a risk that gaps will occur between services provided and the services needed by users. To mitigate that risk, the CSA holds extensive consultations with other Canadian government departments, academia, industry, and international partners before selecting scientific and technological areas to support. The CSA's collaborative approach will help identify and close the gaps between supply and demand and ensure a long-term perspective for investments.

A second risk pertains to space capacity in academia and industry. The Canadian space sector, especially small and medium enterprises, remains reliant on continued research and development investments to increase existing growth opportunities and seek new ones. To ensure Canada can seize opportunities to join international space projects, and with the objective of addressing future national needs and priorities, the CSA will work with Canadian industry and academic stakeholders to identify potential ways by which they can better demonstrate their capabilities and play a leadership role.

Many opportunities exist to take an increased role in international partnerships and cooperation. The CSA maintains an active presence within the international coordination forum, keeping for example permanent representatives at the Canadian embassies in Washington and Paris in order to support its relationships with NASA and ESA and to gather timely information on upcoming plans. But technical challenges associated with developing and implementing disruptive technologies and participating in space missions in collaboration with multiple partners represent another major source of uncertainty. The international aspect of most projects conducted by the CSA adds to these challenges. This can lead to scheduling issues and cost increases. In order to mitigate those risks, the CSA will continue with the implementation of improved governance, streamlined and efficient project management processes and financial monitoring tools. These initiatives will also allow the CSA to track and report on the progress of its commitments, assess the effectiveness of its work, and align its resources with priorities, in order to get the results it wants and that Canadians deserve.

Risks	Risk response strategy	Link to the department's Programs	Link to mandate letter commitments or to government-wide and departmental priorities
Gap between stakeholders' expectations and the CSA's provision of products and services Because of possible interruption of missions in progress, insufficiency of infrastructures or personnel in place, delays in project implementation or changes in stakeholders' requirements and priorities, there is a risk of a gap between the partners' expectations and the data and services provided by the CSA; this may affect the achievement of expected outcomes.	Ongoing consultations with federal departments, industry and the academic community regarding long-term requirements; Ongoing consultations during preliminary project phases regarding operational requirements; Assessment of the development of small satellite capabilities with the objective of providing timely and more focused space solutions; Optimal management of the allocation of RADARSAT-2 data portion of the Government of Canada's credit to ensure all federal government users' needs are met within the constraints of the overall allocation; Monitoring of space objects and taking collision-avoidance measures in order to minimize the risk of serious damage to the RADARSAT-2 spacecraft; Negotiate agreements with international and commercial entities to ensure uninterrupted availability of SAR data; State-of-the-art project management practices for the RADARSAT Constellation Mission, ensuring timely delivery of the operational system; and Ongoing consultations with Departments and Industry regarding data exploitation applications that respond to the information needs.	Space Data, Information and Services	Support other departments such as Fisheries and Oceans and the Canadian Coast Guard, Environment and Climate Change, Natural Resources Canada, and Agriculture and Agri-Food to address key responsibilities related to climate change, and resource and ecosystem management.

Risks	Risk response strategy	Link to the department's Programs	Link to mandate letter commitments or to government-wide and departmental priorities
Space sector capacity Canada's space sector capacity may be at risk in the face of the arrival of new international players, uncertain investment levels and potential technology development issues. A decrease in this capacity could make it insufficient to meet Canada's future requirements, including necessary partnerships for maintaining Canada's position in the space field.	Continuous updating of space technology capacity in Canada and internationally; Promotion by the CSA of partnerships between the Canadian private sector and the academic community; Ongoing monitoring of and reporting on Canadian space sector conditions; and Continued partnerships with foreign space agencies, academia and industry with the objective of creating participation opportunities in international missions.	Space Exploration Future Canadian Space Capacity	Supporting scientific research and helping Canadian businesses grow, innovate and export. Support other departments such as Fisheries and Oceans and the Canadian Coast Guard, Environment and Climate Change, Natural Resources Canada, and Agriculture and Agri-Food to address key responsibilities related to climate change, and resource and ecosystem management.
Unexpected technological challenges Unexpected technological challenges and changing requirements induced by the development of technologies in partnerships may lead to scheduling issues or cost increases.	The CSA maintains an active presence within the international coordination forum; Inclusion of various mission opportunities and collaboration alternatives at the planning stage Reduce technological uncertainty by implementing technology development activities early in the project; Assess projects' risks and allocate a financial margin based on the risks' impact and probability levels; Implement improved project management methodology; and Establishment of governance emphasizing open and timely communication with central agencies and the Minister;	Space Exploration Space Data, Information and Services	Supporting scientific research and helping Canadian businesses grow, innovate and export. Support other departments such as Fisheries and Oceans and the Canadian Coast Guard, Environment and Climate Change, Natural Resources Canada, and Agriculture and Agri-Food to address key responsibilities related to climate change, and resource and ecosystem management.

Planned results: what we want to achieve this year and beyond

Program 1.1: Space Data, Information and Services

Description

This Program includes the provision of space-based solutions (data, information and services) and the progression of their utilization. It also serves to install and run ground infrastructure that processes the data and operates satellites. This Program utilizes space-based solutions to assist Government of Canada (GoC) organizations in delivering growing, diversified or cost-effective programs and services within their mandates, which are related to key national priorities, such as sovereignty, defence, safety and security, resource management, environmental monitoring and the North. It also provides academia with data required to perform its own research.

The services delivered through this Program are rendered, and the data and information are generated and processed, with the participation of the Canadian space industry, academia, GoC organizations, national and international organizations, such as: foreign space agencies, not-for-profit organizations, as well as provincial and municipal governments. This collaborative effort is formalized under national and international partnership agreements and contracts.

Planning Highlights

Earth Observation

The major Earth Observation (EO) activity is the continued development and construction of the RADARSAT Constellation Mission (RCM). The RCM helps support Canada's Innovation Agenda[iii] by focusing on developing technologies that will drive the next wave of innovation. The assembly of the first spacecraft started in September 2016 and will be completed in June 2017. The testing of the first spacecraft will be completed by January 2018, at which time the spacecraft will be ready to be shipped to the launch site. Similarly, the second and third spacecraft will be ready for shipment to the launch site by February and May 2018 respectively. The three satellites are scheduled to be launched in July 2018. The RCM will maintain Canada's leadership as a global supplier of C-band satellite radar data for EO applications such as maritime surveillance, monitoring climate change, land use evolution, coastal change, urban subsidence and human impacts on local environments. It will also maintain the position of Canadian industry in space radar technology and value-added product markets.

The CSA will deliver the first flight model of the Extended Interaction Klystron (EIK), a high-power amplifier, as a part of the Canadian contribution to the NASA-CNES (Centre National d'Études Spatiales) Surface Water and Ocean Topography (SWOT) Mission in October 2017. The mission will provide data that will be of great value to Environment and Climate Change

Canada for hydrological and meteorological monitoring and forecasting, and to Fisheries and Oceans Canada for ocean science studies. This contribution secures privileged access for Canadian scientists to the SWOT data, to be launched in 2021.

The CSA will sustain and enhance the capacity of the scientific community to use space-based instrument operations, including the Atmospheric Chemistry Experiment (ACE) on Canada's SCISAT satellite, the Measurement of Pollution in the Troposphere (MOPITT) instrument on the NASA Terra satellite, and the Optical Spectrograph and Infra-Red Imaging System (OSIRIS) on the Swedish Odin satellite.

These missions will continue to contribute to Canada's strategy for monitoring atmospheric pollutants, greenhouse gases, and hydrofluorocarbons (HFCs) from space. Analysis will contribute to international initiatives such as the Montreal Protocol, Intergovernmental Panel on Climate Change assessments, and the Paris Agreement.

Space Environment

The protection of space assets and the safe conduct of space operations are central to the management of space activities. Canada will conduct activities related to space debris monitoring and risk assessment and will participate in international working groups UNCOPUOS (United Nations Committee on the Peaceful Uses of Outer Space) and IADC (Inter-Agency Space Debris Coordination Committee) on best practices and guidelines supporting international collaboration on the peaceful and sustainable use of space.

Satellite Communications and Navigation

The CSA will continue to support the operation of the Maritime Monitoring and Messaging Microsatellite (M3MSat) mission, launched in 2016. This spacecraft provides valuable flight heritage to test innovative technologies before deploying them on a full scale. The CSA also supports the development and demonstration of communication and navigation technologies through its participation in European Space Agency R&D programs.

Program Delivery Risks

All the above activities will be delivered in close collaboration with other governmental departments, academia and industry. The CSA's approach will help identify and close the gaps between supply and demand and ensure a long-term perspective for investments.

Planned results

Expected Result	Performance Indicator	Target	Date to achieve target	2013–14 Actual results	2014–15 Actual results	2015–16 Actual results
1. GoC organizations offer more diversified or cost-effective programs and services due to their utilization of space-based solutions.	1. Number of new GoCs programs offering more diversified or efficient services.	1	31 March 2018	Not available	36*	1

*2014–15 was the first year of the survey and 36 programs were counted as "new" programs offering more diversified or efficient services.

Budgetary financial resources (dollars)

2017–18 Main Estimates	2017–18 Planned Spending	2018–19 Planned Spending	2019–20 Planned Spending
115,240,643	115,240,643	120,578,228	89,831,556

The difference in planned spending for FY 2017–18, 2018–19 and 2019–20 is mainly attributable to the cumulative effect of the reprofiling of funds to develop the RADARSAT Constellation Mission (RCM).

Human resources (full-time equivalents)

2017–18 Planned full-time equivalents	2018–19 Planned full-time equivalents	2019–2020 Planned full-time equivalents
114.6	111.0	106.6

Information on the Canadian Space Agency's lower-level programs can be found on the Canadian Space Agency's website[iv] and in the TBS InfoBase.[v]

Program 1.2: Space Exploration

Description

This Program provides valuable Canadian science, signature technologies and qualified astronauts to international space exploration endeavours. This Program contributes to the Government of Canada's Science and Technology Strategy. It fosters the generation of knowledge as well as technological spinoffs that contribute to a higher quality of life for Canadians. It generates excitement within the population in general and contributes to nation-building. This Program appeals to the science and technology communities. It is targeted mostly towards Canadian academia and international space exploration partnerships. Canadian industry also benefits from the work generated within this Program.

This Program is delivered with the participation of foreign space agencies and Government of Canada (GoC) organizations. This collaborative effort is formalized under international partnership agreement, contracts, grants or contributions.

Planning Highlights

The Space Exploration program contributes to support Canada's Innovation Agenda[iii] by focusing on developing technologies and exploring emerging fields that have the potential to drive innovation across all sectors of the economy, and by taking a proactive role to keep Canada at the forefront of science and technology.

Human Space Flight

The CSA will continue to fulfill its international obligations on the International Space Station (ISS) until 2024, including the replacement of cameras and lights for the Mobile Servicing System (MSS), the operations of the MSS, and the support to astronauts' spacewalk activities using the Canadarm2 and Dextre. By fulfilling these obligations, the CSA gains access to the ISS, which provides opportunities to Canadian universities and industry to develop life science experiments using the unique microgravity environment of the ISS. The CSA will also continue the development of the Dextre Deployable Vision System (DDVS). The DDVS will provide an increased inspection capability for the ISS and will improve the existing space vision capability to position Canadian industry for future space exploration opportunities.

Preparations are underway for the next Canadian astronaut flight to the ISS scheduled in late 2018. In addition, a national astronaut recruitment campaign will conclude with the selection of two new Canadian astronauts in mid-2017.

Health and Life Science

To maintain the capacity of humans to live in space, the health and life science element will continue to support activities to mitigate health risks associated with space flight. Studies on physiology, psychology and radiation will be pursued. Examples of this are Marrow which studies the mechanisms behind the effects of immobility in space; and Vascular Echo, which led to the discovery of accelerated stiffening of the arteries, a potential health risk for astronauts during long space flights. These advances are also used in research that contributes to a higher quality of life for Canadians.

Space Astronomy

Along with NASA and ESA, Canada is a lead partner in the James Webb Space Telescope project, a major space observatory scheduled for launch in 2018. By virtue of the CSA's contribution, Canadian astronomers will have guaranteed access to 5% of the observing time of the Space Telescope. The CSA will continue to develop two of the most critical components of the James-Webb Telescope.

The CAS will continue to support the operation of the Ultra Violet Imaging Telescope (UVIT) - Canada's contribution to the Indian satellite Astrosat which is currently in space.

These contributions provide opportunities to Canadian scientists to play prominent roles in support of the overall space mission objectives and to Canadian industry to develop critical technology solutions to meet national or international mission requirements.

Planetary Science

After its successful launch in September 2016, NASA's OSIRIS-REx spacecraft, carrying Canada's contribution, the Laser Altimeter, is travelling to the asteroid Bennu. The spacecraft will reach its destination in 2018 and return an asteroid sample to Earth in 2023.

The Alpha Particle X-ray Spectrometer science instrument, which is Canada's contribution to the Curiosity Rover now exploring the Martian surface as part of NASA's Mars Science Laboratory mission, will continue to operate and provide data to Canadian scientists.

Program Delivery Risks

The risks associated with Space Exploration's planned initiatives are related to the loss of space sector capacity and the consequent reduction of opportunities to take part in international space exploration missions, thus diminishing Canada's position in this field. A further risk of misalignment exists between the missions planned and implemented by our partners and the CSA's planning and preparation, possibly resulting in lost cooperation opportunities and a reduction in the Agency's ability to achieve its outcomes.

Planned results

Expected Result	Performance Indicator	Target	Date to achieve target	2013–14 Actual results	2014–15 Actual results	2015–16 Actual results
1. Expansion of advanced scientific knowledge acquired through space exploration endeavours.	1. Number of peer-reviewed scientific publications, reports and conference proceedings using space exploration information and produced by researchers (sciences and technologies) in Canada.	275	31 March 2018	242	362	299
2. Multiple use and applications of knowledge and know-how acquired through space exploration endeavours.	1. Number of terrestrial applications of knowledge and know-how acquired through space exploration endeavours.	3	31 March 2018	3	2	7
	2. Number of space re-utilization of knowledge and know-how acquired through space exploration endeavours.	1	31 March 2018	6	2	1

Budgetary financial resources (dollars)

2017–18 Main Estimates	2017–18 Planned Spending	2018–19 Planned Spending	2019–20 Planned Spending
96,455,420	96,455,420	88,855,640	82,470,773

The difference in planned spending for FY 2017–18, 2018–19 and 2019–20 is mainly attributable to the reprofiling of funds of different International Space Station projects in FY 2017–18 and 2018–19. Starting FY 2019–20 the Space Exploration Program will be solely funded by its A-Base budget.

Human resources (full-time equivalents)

2017–18 Planned full-time equivalents	2018–19 Planned full-time equivalents	2019–2020 Planned full-time equivalents
152.7	148.1	147.6

Information on the Canadian Space Agency's lower-level programs can be found on the Canadian Space Agency's website[iv] and in the TBS InfoBase.[v]

Program 1.3: Future Canadian Space Capacity

Description

This Program attracts, sustains and enhances the nation's critical mass of Canadian space specialists, fosters Canadian space innovation and know-how, and preserves the nation's space-related facilities capability. In doing so, it encourages private-public collaboration that requires a concerted approach to future space missions. This Program secures the nation's strategic and ongoing presence in space in the future and preserves Canada's capability to deliver internationally renowned space assets for future generations. It is targeted at Canadian academia, industry and youth, as well as users of Canadian space solutions (Government of Canada (GoC) organizations) and international partners.

This Program is conducted with the participation of funding agencies, GoC organizations along with government facilities and infrastructure, foreign space agencies, not-for-profit organizations and provincial governments. This collaborative effort is formalized under contracts, grants, contributions or national and international partnership agreements.

Planning Highlights

The Future Canadian Space Capacity program contributes to all three priority areas of Canada's Innovation Agenda[iii] by supporting people, technologies and companies of the space sector.

Space Science and Technology

In collaboration with partners and stakeholders in government, industry and academia, the CSA will continue to foster a strong Canadian space sector to support an innovative and knowledge-based economy. By supporting initiatives and activities related to space science and technology development, the CSA aims to foster space innovation and know-how, reduce technological unknowns, preserve the nation's space-related capabilities, and increase commercial potential. Following consultations held with industry representatives, the CSA will experiment with a new framework for the Space Technology Development Program (STDP) to enhance the ability of Canadian space firms, particularly small and medium enterprises (SMEs) to grow and respond to opportunities. The CSA will dedicate 10% of the STDP budget to the implementation of this new approach. The implementation will be assessed and lessons learned will be reported in the 2017–18 Departmental Results Report and shared with space industry. The impact and results will be assessed as part of the next program evaluation given the lag between the allocation of funding to small and medium enterprises by the STDP and technology readiness. The evaluation report will be made public as per Treasury Board's Policy on Results requirements. More information on projects and activities performed by this program can be found in the STDP project list web page.[vi]

Finally, the CSA recognizes that there is a need to further stimulate research, knowledge and innovation, and will help reduce the gap between space R&D and commercialization opportunities, by exploring various means to foster business innovation and economic development in the space sector, such as networks and clusters.

Development of Space Expertise

The CSA will also address the need to have more people in science, technology, engineering and mathematics (STEM) to keep pace with demand for people with the skills to succeed in the digital economy by working with universities, industry and partners. Students in STEM will be provided with space science and technology development funds and partnership opportunities to ensure that the Canadian space sector becomes more productive, innovative and export-oriented.

Space Capability Demonstration

The CSA will offer industry and academia various platforms for capability demonstration. For pre-space demonstration, these include rover deployment to emulate planetary exploration, parabolic flights to replicate microgravity conditions, and stratospheric balloons to emulate space radiation, temperature, and atmospheric pressure. The Stratos balloon program, created in 2011 through the CSA's collaboration with France's space agency (CNES), gives Canadian academia and industry the opportunity to test and validate new technologies and to perform scientific experiments at an altitude where only balloons can be operated. Stratos also contributes to the training and development of a highly qualified workforce: the next generation of Canadian engineers and scientists.

European Market Space

The CSA will continue to manage the Canada-European Space Agency (ESA) Cooperation Agreement, which allow the Canadian space industry to take part in ESA programs and provide new business opportunities on the European market. More specifically, the CSA will work with ESA for the mid-term review of the Cooperation Agreement and initiate the work for its renewal in 2019.

David Florida Laboratory

The David Florida Laboratory (DFL) Infrastructure Accelerated Refit project will be completed during FY 2017–18. Improvements will ensure that the DFL is maintained and that a high level of client satisfaction is sustained. The CSA will also continue to explore business models that could increase the benefits of the DFL for Canada with the aim of optimizing the support provided by the DFL to the Canadian space industry and academia to ensure that assembly, testing and integration facilities meet their needs.

Program Delivery Risks

The main risks identified are the exodus of Canadian highly qualified professionals (HQP) from the space sector for lack of Canadian opportunities; and a mismatch between the global market needs and the expertise and technologies being developed in Canada.

Planned results

Expected Result	Performance Indicator	Target	Date to achieve target	2013–14 Actual results	2014–15 Actual results	2015–16 Actual results
1. Canada holds a space community (academia, industry and government) able to contribute to the sustained and strategic Canadian use of space.	1. Number of FTE* in the Canadian space sector.	10,000 FTE*	31 March 2018	4,434 HQP*	4,360 HQP*	4,226 HQP*
	2. Monetary value of the Canadian space sector R&D investments.	$160 million	31 March 2018	$165 million	$180 million	$146 million

* Indicator number 1 was first introduced on CSA's 2016–17 Report on Plans and Priorities to monitor the overall program's contribution. Number of High Qualified Personnel (HQP) will continue to be monitored as part of the program's performance measurement strategy.

Budgetary financial resources (dollars)

2017–18 Main Estimates	2017–18 Planned Spending	2018–19 Planned Spending	2019–20 Planned Spending
87,170,086	87,170,086	75,973,949	76,954,189

The difference in planned spending for FY 2017–18, 2018–19 and 2019–20 is mainly attributable to the following factors: In line with Budget 2015 and Budget 2016 announcements, additional funding was received for Canada's continued participation in the European Space Agency's Advanced Research in Telecommunications Systems program and the reprofiling of

funds from 2016–17 to FY 2017–18 for the David Florida Laboratory (DFL) Anechoic Test Facility 2 (ATF2).

Human resources (full-time equivalents)

2017–18 Planned full-time equivalents	2018–19 Planned full-time equivalents	2019–2020 Planned full-time equivalents
103.4	108.2	110.8

Information on the Canadian Space Agency's lower-level programs can be found on the Canadian Space Agency's website[iv] and in the TBS InfoBase.[v]

Internal Services

Description

Internal Services are those groups of related activities and resources that the federal government considers to be services in support of programs and/or required to meet corporate obligations of an organization. Internal Services refers to the activities and resources of the 10 distinct service categories that support program delivery in the organization, regardless of the Internal Services delivery model in a department. The 10 service categories are: Management and Oversight Services; Communications Services; Legal Services; Human Resources Management Services; Financial Management Services; Information Management Services; Information Technology Services; Real Property Services; Materiel Services; and Acquisition Services.

Planning Highlights

The CSA will continue to build on its knowledge of the Canadian space sector and the opportunities and challenges facing its growth and competitiveness.

By June 2017, the CSA will have developed a space strategy that outlines how Canada can use space to drive broad economic growth and leverage the benefits of space for Canadians in alignment with the themes of the government's Innovation Agenda and other key government priorities.

The CSA will continue working with the Department of Innovation, Science and Economic Development to support the revitalization of the Minister's Space Advisory Board, which is expected to consult stakeholders on the key elements of the space strategy.

The CSA will strengthen mechanisms to provide clear oversight and accountability in Canada's investments in space by reviewing the framework used to report on results as per Treasury Board Secretariat's new Policy on Results. The CSA will publish its annual State of the Canadian Space Sector Report. In addition, the CSA will continue the implementation of its five-year Evaluation Plan by performing evaluation of the following programs over the next fiscal year:

- Space Astronomy and Planetary Missions
- Space Expertise and Proficiency
- Scientific Missions and Science Data Utilization
- Communications Missions and Communications Services Utilization
- Human Space Missions and Support and International Space Station Utilization

In order to ensure modern, efficient and relevant delivery of internal services, the CSA will continue integrating renewal initiatives for the public service in strategic and operational plans to

create a streamlined and efficient organization that will shape the CSA's future and allow it to meet the challenges ahead. In particular the CSA will:

- implement its three year (2017–20) People-effective Management Strategy, an integrated three-year strategy that focuses on ensuring healthy and empowering work environments, and establishing a productive and skilled workforce;
- continue the implementation of a Brain Friendly program that promotes the health and wellness of CSA employees through awareness, prevention and educational activities;
- continue with the implementation of its three-year information management strategy and information technology plan including the governmental transformation initiatives and projects. This strategy aims to effectively and efficiently manage all information resources of business value, and the organization's IT applications according to their criticality and their life cycle in order to support the CSA's mandate;
- continue to perform accelerated infrastructure upgrades and repairs at the David Florida Laboratory to maintain its capacities for assembly, integration and testing (AIT) of spacecraft and space components; and
- perform accelerated security-related infrastructure upgrades at the John H. Chapman Space Centre; continue to develop and implement a departmental security framework to mitigate key corporate security risks; implement mandatory training; and continue to raise staff awareness on the importance of safety issues.

Budgetary financial resources (dollars)

2017–18 Main Estimates	2017–18 Planned Spending	2018–19 Planned Spending	2019–20 Planned Spending
54,943,762	54,943,762	47,247,580	48,625,752

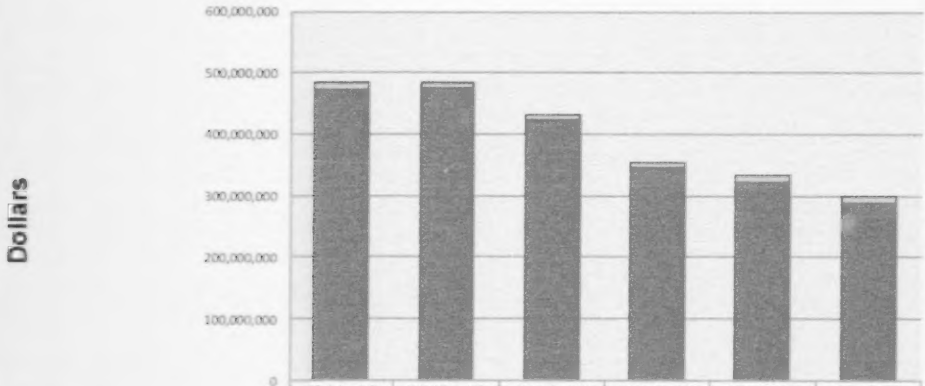
The difference in planned spending for FY 2017–18, 2018–19 and 2019–20 is mainly attributable to the following factors: In line with the 2016 Federal Infrastructure Initiative, additional funding will be received in 2017–18 for the CSA's infrastructure upgrades and security enhancement projects. Starting FY 2018–19 the Internal Services Program will be solely funded by its A-Base budget.

Human resources (full-time equivalents)

2017–18 Planned full-time equivalents	2018–19 Planned full-time equivalents	2019–2020 Planned full-time equivalents
263.9	267.3	269.6

Spending and human resources

Planned spending



	2014–15	2015–16	2016–17	2017–18	2018–19	2019-20
Sunset Programs – Anticipated	0	0	0	0	0	0
Statutory	9,918,684	9,803,222	10,036,658	9,155,402	9,404,577	9,450,421
Voted	473,400,704	473,625,059	422,358,163	344,654,509	323,250,820	288,431,849
Total	483,319,388	483,428,281	432,394,821	353,809,911	332,655,397	297,882,270

Budgetary planning summary for Programs and Internal Services (dollars)

Programs and Internal Services	2014–15 Expenditures	2015–16 Expenditures	2016–17 Forecast Spending	2017–18 Main Estimates	2017–18 Planned Spending	2018–19 Planned Spending	2019–20 Planned Spending
Strategic Outcome: Canada's exploration of space, provision of space services and development of its space capacity meet the nation's needs for scientific knowledge, innovation and information.							
Space Data, Information and services	175,496,334	209,187,061	190,502,084	115,240,643	115,240,643	120,578,228	89,831,556
Space Exploration	97,329,795	96,419,798	94,895,945	96,455,420	96,455,420	88,855,640	82,470,773
Future Canadian Space Capacity	58,018,955	61,804,033	70,873,949	87,170,086	87,170,086	75,973,949	76,954,189
Subtotal	**330,845,084**	**367,410,892**	**356,271,978**	**298,866,149**	**298,866,149**	**286,407,817**	**249,256,518**
Internal Services Subtotal	45,245,854	45,388,166	50,094,327	54,943,762	54,943,762	47,247,580	48,625,752
Total	**379,090,938**	**412,799,058**	**406,366,305**	**353,809,911**	**353,809,911**	**332,655,397**	**297,882,270**

The CSA's expenditure profile variation since FY 2014–15 is primarily the result of investments to develop the RADARSAT Constellation Mission (RCM) as announced in Budget 2010. The CSA has received additional funding from other government departments in order to complete the RCM funding profile. More information with regards to the CSA's expenditure profile is provided in the "Departmental Spending Trend" graph above.

The funding profiles of the CSA's projects and missions vary from year to year and therefore have an impact on the Expenditures, the Forecast Spending as well as the Planned Spending by Program. These variations are presented in the "Budgetary Planning Summary for Strategic Outcome and Programs (dollars)" table above.

Planned human resources

Human resources planning summary for Programs and Internal Services (full-time equivalents)

Programs and Internal Services	2014–15 Full-time equivalents	2015–16 Full-time equivalents	2016–17 Forecast full-time equivalents	2017–18 Planned full-time equivalents	2018–19 Planned full-time equivalents	2019–20 Planned full-time equivalents
Strategic Outcome: Canada's exploration of space, provision of space services and development of its space capacity meet the nation's needs for scientific knowledge, innovation and information.						
Space Data, Information and services	103.8	102.6	104.1	114.6	111.0	106.6
Space Exploration	164.4	154.8	150.0	152.7	148.1	147.6
Future Canadian Space Capacity	89.5	87.2	105.1	103.4	108.2	110.8
Subtotal	**357.7**	**344.6**	**359.1**	**370.7**	**367.3**	**365.0**
Internal Services Subtotal	235.2	246.8	246.0	263.9	267.3	269.6
Total	**592.2**	**591.4**	**605.2**	**634.6**	**634.6**	**634.6**

The progressive increase in the number of FTEs starting in 2016–17 is mainly related to the following items:

- Additional government-furnished personnel over the next five years as per contractual obligation of the RCM Project in order to prepare for the transition to the operations phase; and
- Additional personnel requirements to address some gaps and priorities, which include an increased investment in students in line with attracting the new generation of public servants.

Estimates by vote

For information on the Canadian Space Agency's organizational appropriations, consult the 2017–18 Main Estimates.[vii]

Future-Oriented Condensed Statement of Operations

The Future-Oriented Condensed Statement of Operations provides a general overview of the Canadian Space Agency's operations. The forecast of financial information on expenses and revenues is prepared on an accrual accounting basis to strengthen accountability and to improve transparency and financial management.

Because the Future-Oriented Condensed Statement of Operations is prepared on an accrual accounting basis, and the forecast and planned spending amounts presented in other sections of the Departmental Plan are prepared on an expenditure basis, amounts may differ.

A more detailed Future-Oriented Statement of Operations and associated notes, including a reconciliation of the net cost of operations to the requested authorities, are available on the Canadian Space Agency's website.[iv]

Future-Oriented Condensed Statement of Operations for the year ended March 31, 2018 (dollars)

Financial information	2016–17 Forecast results	2017–18 Planned results	Difference (2017–18 Planned results minus 2016–17 Forecast results)
Total expenses	352,025,526	326,547,500	(25,478,026)
Total revenues	35,000	28,005	(6,994)
Net cost of operations before government funding and transfers	351,990,526	326,519,495	(25,471,032)

Expenses

Total expenses are expected to decrease by $25,478,026 (7%) in 2017–18 in comparison with the forecast results of 2016–17. The decrease is mainly attributable to less data (imagery) purchases from RADARSAT-2 data credit planned in 2017–18 and a loss on a write-off of tangible capital assets forecasted in 2016–17.

Expenses are mainly related to professional and special services, amortization and salaries and fringe benefits. The expenses include planned spending presented in this Departmental Plan as well as expenses not mentioned such as amortization, services provided without charge by other government departments, and severance benefits and vacation pay liability adjustments.

Revenues

Total revenues are projected to be $1,617,133 in 2017–18. Most of the revenues are generated from the sales of goods and services and from other revenues (penalty revenues). The Agency's respendable revenues are projected to be $28,005 and represent revenues from Crown Asset Disposition.

Supplementary information

Corporate information

Organizational Profile

Minister of Innovation, Science and Economic Development:
The Honourable Navdeep Bains, P.C., M.P.

Minister of Science:
The Honourable Kirsty Duncan, P.C., M.P.

Minister of Small Business and Tourism and Leader of the Government in the House of Commons:
The Honourable Bardish Chagger, P.C., M.P.

Institutional Head:
Sylvain Laporte, President

Ministerial Portfolio:
Innovation, Science and Economic Development

Enabling Instrument(s):
Canadian Space Agency Act, S.C. 1990, c. 13

Year of Incorporation / Commencement:
Established in March 1989

Other:
The Canadian Space Agency was established in 1989. Approximately 84% of its employees work at the headquarters located at the John H. Chapman Space Centre, in St-Hubert, Quebec. The remaining personnel serve the CSA at the David Florida Laboratory in Ottawa, Ontario and its Policy and planning offices in Gatineau, Quebec, with officials in Houston, Washington and Paris.

Reporting framework

The Canadian Space Agency Strategic Outcome and Program Alignment Architecture of record for 2017–18 are shown below:

1. Strategic Outcome: Canada's exploration of space, provision of space services and development of its space capacity meet the nation's needs for scientific knowledge, innovation and information.

1.1 Program: Space Data, Information and Services
- **1.1.1 Sub-Program:** Earth Orbit Satellite Missions and Technology
  - **1.1.1.1 Sub-Sub-Program:** Earth Observation Missions
  - **1.1.1.2 Sub-Sub-Program:** Communications Missions
  - **1.1.1.3 Sub-Sub-Program:** Scientific Missions
- **1.1.2 Sub-Program:** Ground Infrastructure
  - **1.1.2.1 Sub-Sub-Program:** Satellite Operations
  - **1.1.2.2 Sub-Sub-Program:** Data Handling
- **1.1.3 Sub-Program:** Space Data, Imagery and Services Utilization Development
  - **1.1.3.1 Sub-Sub-Program:** Earth Observation Data and Imagery Utilization
  - **1.1.3.2 Sub-Sub-Program:** Communications Services Utilization
  - **1.1.3.3 Sub-Sub-Program:** Scientific Data Utilization

1.2 Program: Space Exploration
- **1.2.1 Sub-Program:** International Space Station (ISS)
  - **1.2.1.1 Sub-Sub-Program:** International Space Station Assembly and Maintenance Operations
  - **1.2.1.2 Sub-Sub-Program:** International Space Station Utilization
- **1.2.2 Sub-Program:** Exploration Missions and Technology
  - **1.2.2.1 Sub-Sub-Program:** Space Astronomy Missions
  - **1.2.2.2 Sub-Sub-Program:** Planetary Missions
  - **1.2.2.3 Sub-Sub-Program:** Advanced Exploration Technology Development
- **1.2.3 Sub-Program:** Human Space Missions and Support
  - **1.2.3.1 Sub-Sub-Program:** Astronaut Training and Missions
  - **1.2.3.2 Sub-Sub-Program:** Operational Space Medicine
  - **1.2.3.3 Sub-Sub-Program:** Health and Life Sciences

1.3 Program: Future Canadian Space Capacity
- **1.3.1 Sub-Program:** Space Expertise and Proficiency
- **1.3.2 Sub-Program:** Space Innovation and Market Access
  - **1.3.2.1 Sub-Sub-Program:** International Market Access
  - **1.3.2.2 Sub-Sub-Program:** Enabling Technology Development
- **1.3.3 Sub-Program:** Qualifying and Testing Services

1.4 Internal Services

Supporting information on lower-level programs

Supporting information on lower-level programs is available on the Canadian Space Agency's website[iv] and in the TBS InfoBase.[v]

Supplementary information tables

The following supplementary information tables are available on the Canadian Space Agency's website.[iv]

- Details on transfer payment programs of $5 million or more
- Status report on transformational and major Crown projects
- Upcoming internal audits for the coming fiscal year
- Upcoming evaluations over the next five fiscal years

Federal tax expenditures

The tax system can be used to achieve public policy objectives through the application of special measures such as low tax rates, exemptions, deductions, deferrals and credits. The Department of Finance Canada publishes cost estimates and projections for these measures each year in the Report on Federal Tax Expenditures.[viii] This report also provides detailed background information on tax expenditures, including descriptions, objectives, historical information and references to related federal spending programs. The tax measures presented in this report are the responsibility of the Minister of Finance.

Organizational contact information

Canadian Space Agency
Communications and Public Affairs
Telephone: 450-926-4370
Fax: 450-926-4352
Email: asc.medias-media.csa@canada.ca

Appendix: definitions

appropriation (crédit)

Any authority of Parliament to pay money out of the Consolidated Revenue Fund.

budgetary expenditures (dépenses budgétaires)

Operating and capital expenditures; transfer payments to other levels of government, organizations or individuals; and payments to Crown corporations.

Core Responsibility (responsabilité essentielle)

An enduring function or role performed by a department. The intentions of the department with respect to a Core Responsibility are reflected in one or more related Departmental Results that the department seeks to contribute to or influence.

Departmental Plan (Plan ministériel)

Provides information on the plans and expected performance of appropriated departments over a three-year period. Departmental Plans are tabled in Parliament each spring.

Departmental Result (résultat ministériel)

A Departmental Result represents the change or changes that the department seeks to influence. A Departmental Result is often outside departments' immediate control, but it should be influenced by program-level outcomes.

Departmental Result Indicator (indicateur de résultat ministériel)

A factor or variable that provides a valid and reliable means to measure or describe progress on a Departmental Result.

Departmental Results Framework (cadre ministériel des résultats)

Consists of the department's Core Responsibilities, Departmental Results and Departmental Result Indicators.

Departmental Results Report (Rapport sur les résultats ministériels)

Provides information on the actual accomplishments against the plans, priorities and expected results set out in the corresponding Departmental Plan.

full-time equivalent (équivalent temps plein)

A measure of the extent to which an employee represents a full person-year charge against a departmental budget. Full-time equivalents are calculated as a ratio of assigned hours of work to scheduled hours of work. Scheduled hours of work are set out in collective agreements.

government-wide priorities (priorités pangouvernementales)

For the purpose of the 2017–18 Departmental Plan, government-wide priorities refers to those high-level themes outlining the government's agenda in the 2015 Speech from the Throne, namely: Growth for the Middle Class; Open and Transparent Government; A Clean Environment and a Strong Economy; Diversity is Canada's Strength; and Security and Opportunity.

horizontal initiatives (initiative horizontale)

A horizontal initiative is one in which two or more federal organizations, through an approved funding agreement, work toward achieving clearly defined shared outcomes, and which has been designated (e.g. by Cabinet, a central agency, etc.) as a horizontal initiative for managing and reporting purposes.

Management, Resources and Results Structure (Structure de la gestion, des ressources et des résultats)

A comprehensive framework that consists of an organization's inventory of programs, resources, results, performance indicators and governance information. Programs and results are depicted in their hierarchical relationship to each other and to the Strategic Outcome(s) to which they contribute. The Management, Resources and Results Structure is developed from the Program Alignment Architecture.

non-budgetary expenditures (dépenses non budgétaires)

Net outlays and receipts related to loans, investments and advances, which change the composition of the financial assets of the Government of Canada.

performance (rendement)

What an organization did with its resources to achieve its results, how well those results compare to what the organization intended to achieve, and how well lessons learned have been identified.

Performance indicator (indicateur de rendement)

A qualitative or quantitative means of measuring an output or outcome, with the intention of gauging the performance of an organization, program, policy or initiative respecting expected results.

Performance reporting (production de rapports sur le rendement)

The process of communicating evidence-based performance information. Performance reporting supports decision making, accountability and transparency.

planned spending (dépenses prévues)

For Departmental Plans and Departmental Results Reports, planned spending refers to those amounts that receive Treasury Board approval by February 1. Therefore, planned spending may include amounts incremental to planned expenditures presented in the Main Estimates.

A department is expected to be aware of the authorities that it has sought and received. The determination of planned spending is a departmental responsibility, and departments must be able to defend the expenditure and accrual numbers presented in their Departmental Plans and Departmental Results Reports.

plans (plan)

The articulation of strategic choices, which provides information on how an organization intends to achieve its priorities and associated results. Generally a plan will explain the logic behind the strategies chosen and tend to focus on actions that lead up to the expected result.

Priorities (priorité)

Plans or projects that an organization has chosen to focus and report on during the planning period. Priorities represent the things that are most important or what must be done first to support the achievement of the desired Strategic Outcome(s).

program (programme)

A group of related resource inputs and activities that are managed to meet specific needs and to achieve intended results and that are treated as a budgetary unit.

Program Alignment Architecture (architecture d'alignement des programmes)

A structured inventory of an organization's programs depicting the hierarchical relationship between programs and the Strategic Outcome(s) to which they contribute.

results (résultat)

An external consequence attributed, in part, to an organization, policy, program or initiative. Results are not within the control of a single organization, policy, program or initiative; instead they are within the area of the organization's influence.

statutory expenditures (dépenses législatives)

Expenditures that Parliament has approved through legislation other than appropriation acts. The legislation sets out the purpose of the expenditures and the terms and conditions under which they may be made.

Strategic Outcome (résultat stratégique)

A long-term and enduring benefit to Canadians that is linked to the organization's mandate, vision and core functions.

sunset program (programme temporisé)

A time-limited program that does not have an ongoing funding and policy authority. When the program is set to expire, a decision must be made whether to continue the program. In the case of a renewal, the decision specifies the scope, funding level and duration.

target (cible)

A measurable performance or success level that an organization, program or initiative plans to achieve within a specified time period. Targets can be either quantitative or qualitative.

voted expenditures (dépenses votées)

Expenditures that Parliament approves annually through an Appropriation Act. The Vote wording becomes the governing conditions under which these expenditures may be made.

Endnotes

i. **CSA's mission and mandate**, http://www.asc-csa.gc.ca/eng/about/mission.asp

ii. **The Minister's mandate letter**, http://pm.gc.ca/eng/mandate-letters

iii. **Canada's Innovaiton Agenda**, https://www.ic.gc.ca/eic/site/062.nsf/eng/h_00051.html

iv. **CSA's reports to Parliament**, http://asc-csa.gc.ca/eng/publications/rp.asp

v. **TBS InfoBase**, https://www.tbs-sct.gc.ca/ems-sgd/edb-bdd/index-eng.html

vi **STDP project list**, http://www.asc-csa.gc.ca/eng/programs/stdp/projects.asp

vii. **2017–18 Main Estimates**, http://www.tbs-sct.gc.ca/hgw-cgf/finances/pgs-pdg/gepme-pdgbpd/index-eng.asp

viii. **Report on Federal Tax Expenditures**, http://www.fin.gc.ca/purl/taxexp-eng.asp